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BULLETIN NO. 92.

CITY MILK SUPPLY.

By WILBER J. FRASER.



URBANA, ILLINOIS, DECEMBER, 1903.

INTRODUCTION.—Owing to the many evils resulting from the use of impure milk, the public has recently taken special interest in the subject of city milk supply, and because of this interest Bulletins 91 and 92 are published at this time. Page 253.

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CITY MILK SUPPLY.

BY WILBER J. FRASER, CHIEF IN DAIRY HUSBANDRY.

INTRODUCTION.

The statements made in this bulletin are the result of seven years' experience in conducting a sanitary dairy at the University of Illinois, where the milk is bottled and delivered for direct consumption. They are also the result of investigations in the contamination of milk reported in Bulletin No. 91. Both of these bulletins and Circular No. 73 are published at the present time because of the recent interest manifested by the public in city milk supply.

The methods commonly employed in the production of milk are so faulty, and the evils resulting from the use of impure milk so numerous and of such a serious nature, that every one interested in the public welfare should be anxious to bring about an improvement. In many cities and towns of the State, much attention is paid to the water supply, and large sums of money are expended in obtaining good and pure water; yet in most cities no attention is given to the quality of milk furnished, which to many, especially the children, is of even greater moment than the water supply. In but few cities of the State is it possible to get a regular supply of milk that has been produced under really clean conditions, thoroughly cooled and bottled in a proper manner, and which parents feel sure is safe for infant feeding. Among the reasons why a reform should be instituted are the following:

No other article of food is so generally used by all classes of people.

About one-third of all the milk produced by the 17,000,000 cows in the United States is sold for direct consumption, and much of it is consumed in its raw state.

No other food is more healthful and economical than milk when pure, and none is more dangerous to health when carelessly handled.

Milk being an opaque liquid, its quality and cleanly condition cannot be easily detected by its appearance.

Many infants and invalids subsist almost, if not entirely, upon milk, and it is of vital importance that milk for such persons be as pure and free from bacteria as possible.

Milk is an ideal medium for the growth of germs; because of this fact it is especially important that it be handled with the greatest care so that no disease germs may be allowed to gain access to it.

Since the invention of the Babcock test and the cream separator, dairymen can easily standardize the milk and cream they sell, and should be required to do so.

To secure desired results care must be exercised at every step of milk production and delivery. There is little use in observing all but one of the precautions here suggested for the production of high grade milk, as this one neglect spoils the whole.

Even by exercising the greatest care in the production of milk, it cannot be secured in a commercial way from the cow, germ free. It is for this reason that it must be protected from further contamination and kept at a low temperature during delivery and subsequently, or the bacterial content will soon be enormous.

The efforts that have been made to induce dairymen to use more sanitary methods in handling their milk have often resulted in failure. One important reason for this is not hard to find, for milk cannot be produced under sanitary conditions as cheaply as in the common slovenly manner, and when the price of the product is raised, the consumer, not appreciating the added value to himself, often objects to paying the advanced price. This naturally discourages further efforts toward improved methods in production. When consumers insist on having milk of known quality and purity, and are willing to pay a slightly advanced price for it, such milk will be supplied.

If its true food value were more fully appreciated, milk would be used much more freely than it now is, to the advantage of both the health and economical sustenance of the people. A quart of three percent milk, costing five cents, will furnish about the same amount of nutrition as three-fourths of a pound of meat, costing nine cents; yet people invariably consider milk something of a luxury, and think they are economizing by restricting its use as much as possible, although they buy meat freely, considering it one of the necessities of life. Few people realize that the elements needed to nourish the body may be obtained from milk more cheaply than from meat, and that milk takes the place of other foods, thus diminishing the quantity of other food needed.

The public has long been defrauded by dishonest and unscrupulous milk dealers, and has suffered from the slovenly methods of the careless dairyman. The honest dealers who furnish clean milk have been and are still having a hard fight with dishonest competition and the indifference of the public. The most effective remedy for this difficulty is for the public to patronize those only who furnish a good grade of milk, and are willing to guarantee it.

It is the aim of this bulletin to bring the consumers and the better class of dairymen together; to show both the importance of handling milk in a cleanly, sanitary manner; also to present to dairymen improved methods of handling milk and delivering it to the vast number of people living in our cities. There is yet much to be learned along this line, but certain facts are well established, and it is of these that this bulletin is to treat.

THE CONSUMER'S INTERESTS.

The consumer is especially interested in five things in connection with his milk supply, and for these the producer should be responsible:

First, that the milk be clean.

Second, that the milk keep at least twenty-four hours after being delivered to the consumer, if held at a temperature of 60° or below.

Third, that the flavor of the milk be not injured by improper feeding, careless methods in handling, or by the development of certain species of bacteria which cause bad flavors.

Fourth, that the milk be not injurious to health; that it contain no disease-producing germs or any form of preservative.

Fifth, that the milk have a certain known composition which is uniform from day to day.

The consumer has a right to demand that milk furnished him meets the above requirements, and unless it does, he should refuse to take it.

In order that milk may conform to the above requirements, the following suggestions as to the care of the barn, cows, dairy, utensils, etc., must be carried out.

CARE OF THE YARD.

In the production of clean milk no one thing is of more importance than keeping the cows out of the mud and filth of a dirty barnyard. The yard should be graded to slope gently from the barn, and should be covered with gravel or cinders sufficiently deep to form a hard surface. In this way the cows will be kept out of the mud, thus preventing their bellies and udders from becoming soiled.

It is advisable to haul the manure directly to the field from the barn, but if this is not feasible it should be removed at least one hundred feet from the barn. In no case should it be allowed to accumulate against or near the dairy barn, and no swine pen should be nearer than two hundred feet, since the odors are readily absorbed by milk.

BARNs AND STABLES.

Costly barns or stables are not essential to the production of clean milk or to the maintenance of a dairy herd at its highest efficiency. To obtain the best results, it is important, however, that the cows be kept comfortable at all times. To do this there are several essentials with which a barn must be provided. It must have a roof that does not leak, sides that do not allow the wind to blow through, and doors that will close tightly.

It is of the utmost importance in keeping cows clean that the platform on which they stand be of the proper length. If it is too short, the cows cannot lie down comfortably, and if too long, the droppings will fall



CUT 1.—AN UNGRADED YARD IN WHICH THE MANURE IS ALLOWED TO ACCUMULATE.



CUT 2.—A WELL-GRADED YARD COVERED WITH SIX INCHES OF CINDERS.

on the rear of the platform and the cows will become soiled when lying down. As cows vary in length, the platform should be longer from the manger to the gutter, at one end of the barn, and gradually taper to six or eight inches shorter at the other end. When large herds are kept, the platform on one side of the barn may be longer than on the other side, and the cows arranged accordingly. A still better arrangement is some form of movable manger so that the length of the platform can be adjusted to suit each individual cow. With this arrangement all can be lined up on the gutter, which will be a great help in keeping the cows clean.

LIGHT AND VENTILATION.

Two things almost universally lacking, or at least inadequately supplied in dairy barns, are light and pure air. These are easily obtained, and although absolutely essential to the best health of the herd and the economic production of clean milk, they are rarely appreciated. There should be from three-fourths to one and one-half square feet of glass for every linear foot of outside wall in a dairy barn.

Many barns are not provided with any system of ventilation whatever, as but few dairymen realize that pure air is just as essential to the economic production of untainted milk as is the feed a cow consumes. Digestion and assimilation, like the burning of coal in a stove, are processes of combustion. The stove may be filled with coal, but if the drafts are kept tightly closed, the coal will not burn, as sufficient oxygen is not provided. Neither can a cow's feed be properly digested and assimilated without an abundance of oxygen, and unless this is supplied, a great waste of food, as well as impaired health of the cow, will result.

Much has been said about the number of cubic feet of air space that should be allowed for a cow, but this is of little consequence in comparison with the more important question of ventilation, or change of air. In order not to get a greater degree of impurity in the air than is permissible with good results, each cow should be supplied with 3,540 cubic feet of air an hour. The size of the ventilating flues to be provided will depend upon the number of cows in the stable. About two feet square is a good size, and if so constructed as to cause the air to move three hundred feet a minute, this will furnish ventilation for twenty cows. Two flues this size would be sufficient for forty cows, and five would be required for one hundred cows.

ADVANTAGES OF WHITEWASH.

To be sanitary a dairy barn should be whitewashed at least once a year. An interior like the one shown in cut 3, with a few boards laid overhead at irregular intervals, with hay hanging through, and with the sides and ceiling in no better condition, cannot be properly whitewashed. The ceiling should be tight, excluding all dust and chaff from above, and

the sides should be smooth, thus affording a firm surface to which the whitewash can cling.

Whitewash is one of the cheapest disinfectants, and can be easily and rapidly applied with a spray pump. It must be carefully strained before using in the pump, as any lumps will clog the spray nozzle.

CLEANLINESS IN MILKING.

In the production of milk for direct consumption, it is imperative that the udders be clean before milking, as it is from soiled udders that milk as ordinarily produced gets the greatest amount of contamination.

In Table 7, Bulletin 91, is given the weight of dirt which fell from washed and unwashed udders during milking. From this it is seen that with udders that were apparently clean, an average of three and one-half times as much dirt fell from the unwashed udders as from the same udders after they were washed. With soiled udders the average was eighteen, and with muddy udders the average was ninety times as much dirt from the unwashed as from the same udders after washing.

These averages clearly show that all udders must be washed before milking if high-grade milk of good keeping quality is to be produced.

THE CARE OF MILK.

As soon as it is drawn milk should be removed from the stable to a place provided for the purpose, and there aerated and cooled to 50° F., or below if possible. This should be done either by setting the cans into a tank of cold water, and stirring occasionally, or by passing the milk over a cooler. The latter method is to be preferred if the cooling can be done in a pure atmosphere free from dust. It is of great importance to have a small milk-house, or some clean room away from the odors of the stable, in which to care for the milk.

The sooner milk is thoroughly cooled after it is drawn, and the lower the temperature to which it is brought, the better. Bacteria that get into milk during the process of milking develop very rapidly as long as milk remains at about the temperature at which it was drawn, but as soon as cooled to 60°, they develop slowly, and if cooled to 40° their growth is almost entirely stopped. Milk cooled to this temperature as soon as drawn, and held there, will remain sweet and in good condition much longer than if cooled to only 70° or 75°.

Dairymen who deliver milk in cans, measuring out the amount wanted at each door, sell with the milk the dust and germs that collect in the measures as they drive along the street. To prevent contamination during delivery and subsequently, all milk must be bottled in the dairy. Some dairymen bottle milk in the wagon on the route, using bottles collected from houses just visited. This dangerous practice cannot be too strongly condemned, and should be prohibited by law. If



CUT 3.—BARNs OF THIS CHARACTER ARE ENTIRELY TOO NUMEROUS.



CUT 4.—A SANITARY BARN, CLEAN AND WHITEWASHED.

the bottles are not taken to the dairy and washed and sterilized before being filled, milk delivered in bulk is safer, although possibly not so clean.

CARE OF DAIRY UTENSILS.

One of the first essentials in keeping dairy utensils clean is to have vessels with smooth surfaces. This fact should be kept in mind when purchasing, and if all seams are not flushed smooth with solder, this should be done. All utensils should be of tin, and as soon as the tin is worn off on the inside, they should be discarded, for they cannot be



CUT 5.—BOTTLED MILK HELD IN ICE-WATER IN REFRIGERATOR UNTIL DELIVERED.

properly cleaned when in this condition. All utensils should be washed as soon as possible after using, since the longer the milk remains on them, the harder they will be to clean. They should first be rinsed with lukewarm water to remove the milk, then washed with hot water and soap, or some alkali, and scalded with boiling water, or with steam if it is available. Cans should never be tightly closed when not in use, and should be placed on a rack in an inverted position so that the dust cannot blow into them. If possible, they should be placed where the sun will shine on them, as that will do much toward keeping them pure and sweet.

Bottles used to deliver milk for direct consumption must be taken to the dairy after each using and thoroughly washed and sterilized to kill all disease germs. If this is not done, disease may be carried from one house to another by means of the bottles.

STANDARD MILK.

By standard milk and cream is meant that which has a certain known composition, thus establishing a true basis for valuation.

Let it be clearly understood by producers, consumers, city councils, and everybody that in these days the dealer can furnish the customer with milk of any desired richness, without regard to the quality ordinarily yielded by the cow, and all milk should be either so standardized or else bought and sold according to its natural composition.

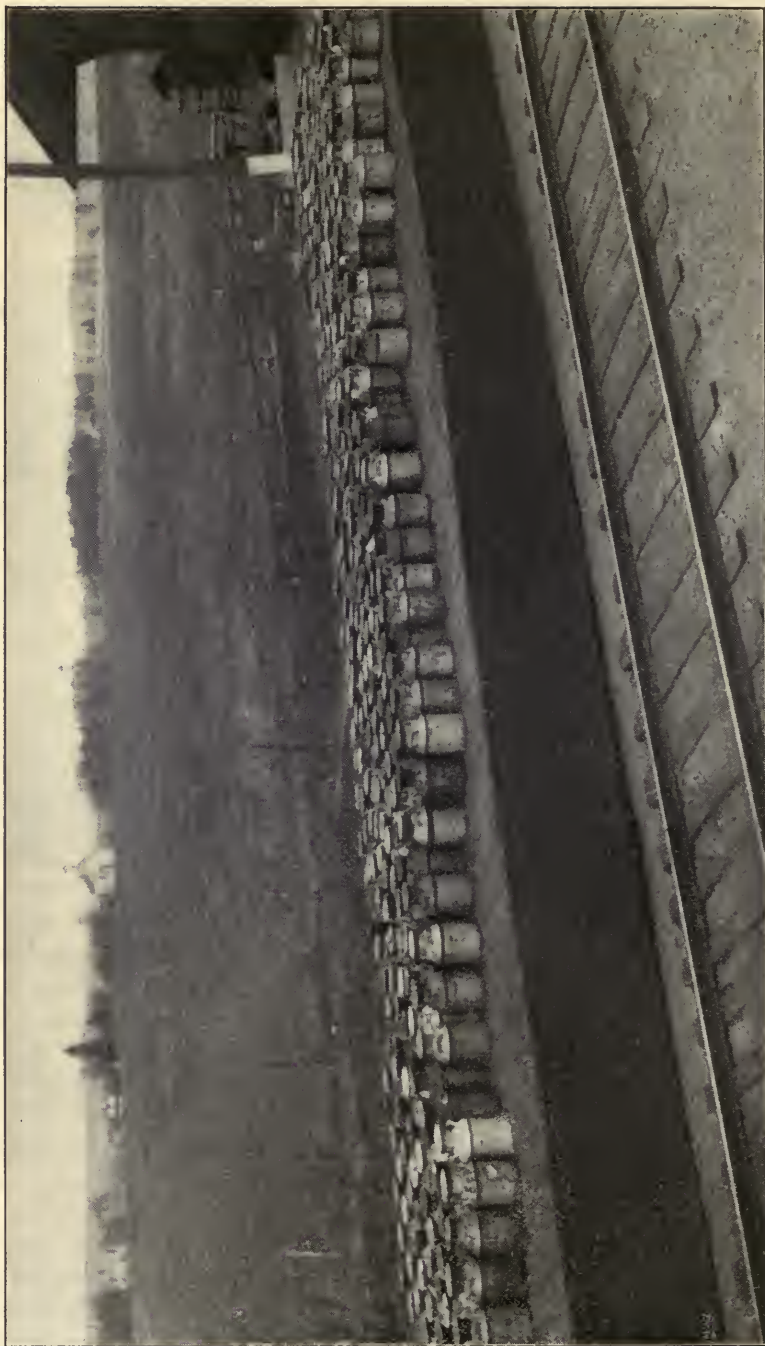
Selling milk by measure alone is unjust to the producer as well as to the consumer. While the fallacy of the system is apparent to a few, the majority of people seem to think that milk is milk, and that one quart is worth as much as another, so long as it is still sweet. The reason for this is partly a lack of knowledge as to what constitutes good milk, and partly because milk is an opaque liquid, and it is difficult to judge of its composition or food value simply by appearance. For this reason, many unscrupulous milk dealers dilute their milk with water or remove a portion of the cream.

State legislatures and city councils have attempted to overcome this difficulty by passing laws and ordinances making it unlawful to change the composition of milk. Where these laws were enforced, they stopped the dilution of milk to a great extent, but did not tend to compel milk dealers to sell milk of any known composition or on the basis of its food value.

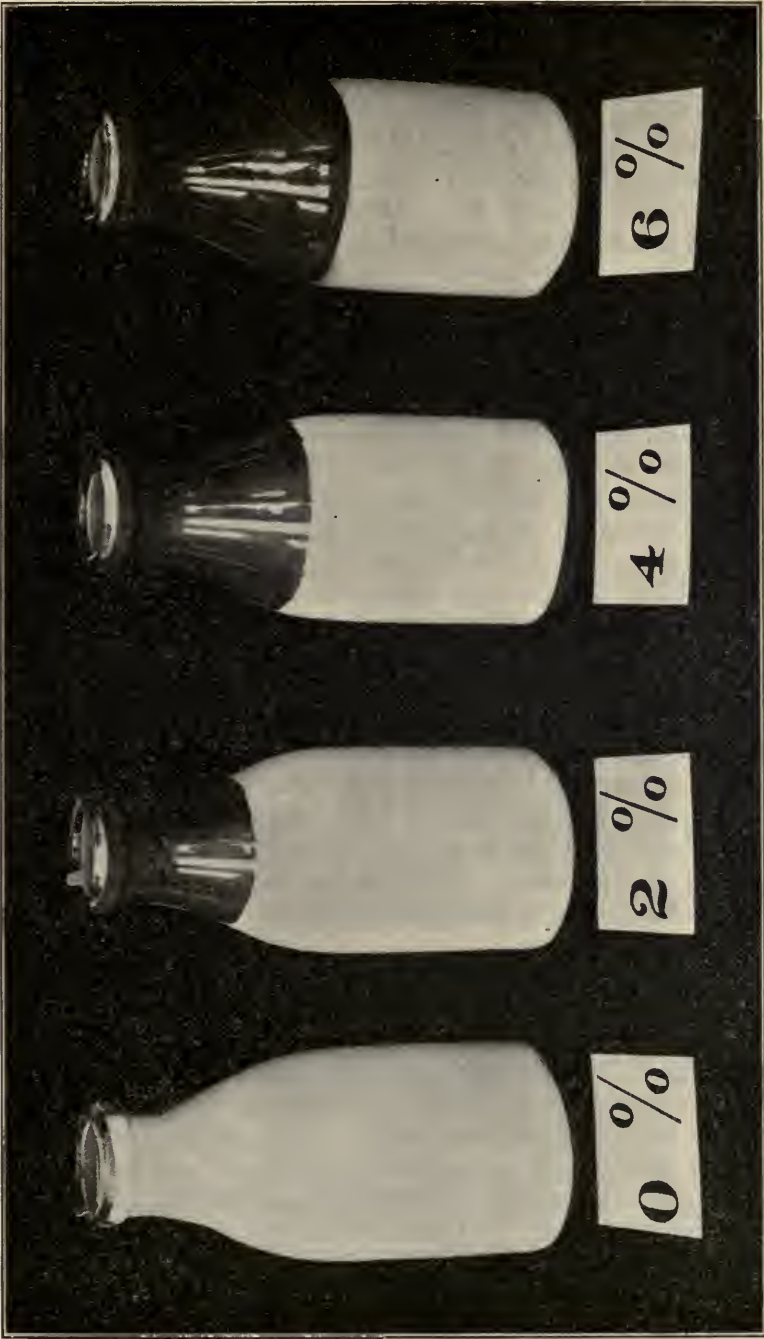
The next attempt to remedy the difficulty was to fix a certain standard, below which it was unlawful to sell milk. Most of the states and some cities passed laws to this effect. These standards seldom require more than three percent fat and twelve percent total solids. The city or state standards, even where they exist, have not reached the difficulty, as they make the sale of milk coming direct from some individual cows that give milk low in fat, unlawful, while it is good, wholesome milk, and a perfectly legitimate product when sold at its proper price. But what is even worse, this system hinders the man who produces rich milk from getting the price he should according to its food value and cost of production. Milk containing a high percent of fat is not only worth more for food, but costs more to produce than milk containing a low percent of fat, and the price should be governed by its composition and food value and not by its bulk.

STANDARDIZING MILK AND CREAM.

Since fat in milk is the most variable constituent, the other solids remaining fairly constant, standardizing milk is a comparatively simple matter. All that is necessary is to add or remove a certain amount of butter fat, which is easily done by means of the centrifugal separator,



CUT 6.—MILK CANS AT THE RAILWAY STATION.



CUT 7.—STANDARDIZED MILK, SHOWING THE AMOUNT OF CREAM ON MILK CONTAINING THE DESIGNATED PERCENT OF BUTTER FAT.

or by letting the cream rise by gravity. While it is true that milk from individual cows varies somewhat from day to day, the mixed milk of a herd that is milked at regular times each day will be practically constant for that herd, because all of the cows will not test high or low on the same day. By testing the milk of a herd occasionally, the percent of fat in the milk may be known at all times with reasonable accuracy, together with the amount of butter fat that should be added or removed to bring it to the proper standard. If the separator does good work, and the amount of milk handled is small, so that it does not warrant testing every day, it may be run very close to the desired percent of fat by testing once a week, so as to be sure that it is up to the required standard. Where the quantity of milk handled is large, it is more economical to run tests frequently, and keep the fat at exactly the desired percent. Even if the percent of fat varies but slightly, it makes a great difference in profit in the course of the year in a large business. If 1,000 gallons of milk are sold daily at the price given in Table 1, and the percent of fat in the milk is 4.5, when only 4 percent milk is required, the loss to the one selling the milk is $1\frac{1}{2}$ cents a gallon, or \$15 a day; this in a year would amount to \$5,475.

The only apparatus necessary to standardize milk is a cream separator and a Babcock milk test. Surely no dairyman who has a business of any consequence can afford to be without these machines. For dairymen handling but a small amount of milk, the same results may be accomplished by setting the milk for a time, and skimming off the cream. In this case all that is necessary is a Babcock test, which may be obtained from any milk supply house for four dollars. In this work, skim milk containing practically no fat must be added or removed. If the skim milk used contains fat, proper allowance must be made according to the amount of fat contained, or the results will obviously be different. Water cannot be used to dilute the milk or the percent of solids not fat will be reduced.

As the percent of albuminoids, milk sugar, and mineral matter are practically the same in milk containing different amounts of butter fat, these are not considered in the following table. From this table it will be seen that if all milk were standardized, and sold according to these prices, dairymen would then receive the legitimate price for their product according to its food value and cost of production, and would not be selling six percent milk in competition with three percent milk and for the same price a quart. Such a method would result in justice to both producer and consumer.

TABLE 1.—RELATIVE VALUE A QUART AND NUMBER OF QUARTS IN A DOLLAR'S WORTH OF MILK OF THE FOLLOWING COMPOSITION AS TO FAT, COMPUTED ACCORDING TO THE FOOD VALUE OF 3 PERCENT MILK AT 5 CENTS A QUART.

	0.1	1	2	3	4	5	6
Percent of fat.....	2.8	3.5	4.2	5.0	5.7	6.5	7.2
Price a quart, cents.....	35.7	28.6	23.8	20.0	17.5	15.4	13.9
Number of quarts a dollar...							

CERTIFIED MILK.

The grade of milk known as "certified" is nothing more than milk of a known composition, as clean and free from bacteria as science and skill can make it, and produced by an inspected herd.

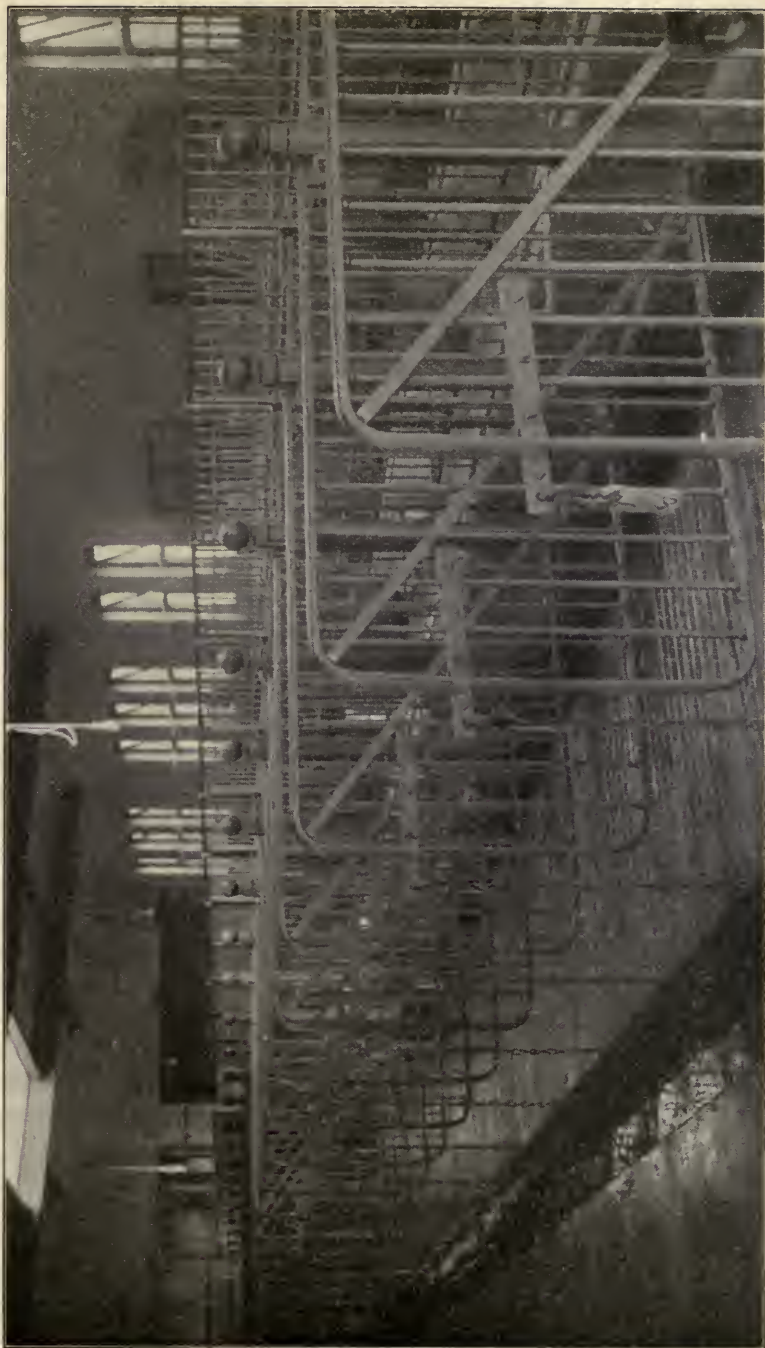
Even in the production of this grade of milk, costly buildings are not necessary, but they should be so constructed as to be easily cleaned, and must be kept in perfect condition. The stable must be cleaned frequently, at least twice a day, when the cows are indoors, and all feeding of dry fodder, bedding, and sweeping must be completed not less than fifteen minutes before beginning to milk, thus allowing time for the dust to settle. Before milking all udders must be washed, whether they appear soiled or not, and the milkers must wash their hands and put on clean suits of some washable material. As soon as drawn, the milk must be removed from the stable to a sanitary dairy, where it is cooled to 50° F. or below, standardized, and bottled. The bottles and all other utensils with which the milk comes in contact must be thoroughly washed and sterilized after each using.

When milk is produced in a manner similar to that described in this bulletin, a public statement should be made certifying to the methods of production and the percent of fat contained. Such milk finds a ready market at an advanced price when its true value is understood.

The easiest and most effective way of letting the patrons know the advantages of high grade milk, and the methods used in its production, is by means of an illustrated circular. This circular should show views in the dairy barn and dairy, describe how the herd is kept, and the milk produced and prepared for the trade. It should be neat and attractive in form, as well as brief and to the point, so that it may be easily read. Copies should be distributed among the patrons, and, together with samples of the milk advertised, given to the influential people of the town. The physicians should be called upon and some means devised for getting them to visit the dairy. If they find everything there in first-class condition, they will not be slow in recommending the milk to their patients. The patrons, too, should be encouraged to visit the dairy where it is possible for them to do so. Few, doubtless, can be induced to pay a personal visit, and the great advantage of the circular is that it



CUT 8.—FEEDING ALLEY IN A SANITARY DAIRY BARN WHERE CERTIFIED MILK IS PRODUCED.



CUT 9.—REAR VIEW, SAME BARN.

will not only reach all the patrons, but it will help greatly in extending the trade.

As an illustration of such a circular, one published several years ago showing the methods used in the University dairy, is reprinted in connection with this bulletin as Circular No. 73. Such a circular will do much to inform the public where good, clean milk can be obtained, and to bring the well-conducted dairies into the prominence they so well deserve.

In all cities there is great need of this grade of milk, and when its production is rightly managed, there is good opportunity for financial gain, as such milk will sell for from eight to twelve cents a quart. Milk of this character has been selling in Chicago for the past six years for twelve cents a quart.

THE CONSUMER'S RESPONSIBILITY.

That milk may reach the table in first-class condition, the consumer has responsibilities as well as the producer. The milkman is frequently blamed for many things for which he is not responsible. However perfect the condition and low the temperature of the milk when delivered, it cannot long remain in good condition unless carefully handled. If milk is to keep, it must be held at a low temperature, at least 60° F., and below if possible.

If milk is not delivered in bottles, care must be taken to protect it from dust, and it must be placed where there are no odors to be absorbed. Bottled milk, being sealed with a pulp cap, cannot absorb odors, and should be left in the bottle until used, not emptied into an open dish. If the cream is to be used first, that can be poured off and the cap replaced, thus protecting the milk left in the bottle. If it is desired to incorporate the cream with the milk, this can easily be done by turning the bottle end over end a few times, holding the finger on the cap to prevent its being pushed out. The milk needed can then be removed and the cap replaced.

IMPROVING CONDITIONS.

"Certified" milk should be the only standard, and it points the direction for improvement over the common methods of milk production. Most of the conditions for the production of certified milk are not expensive. With the majority of dairymen, only a few call for the outlay of additional money. The most important conditions, those involving cleanliness and safety, can be secured without appreciable expense. Here improvement can begin, and should begin at once, and go forward as rapidly as possible until all milk offered for direct consumption is produced according to the standard for certified milk.

Among the reforms that can be secured at insignificant expense, and which should be universally insisted upon, are the following:

To keep the cows clean, and not compel or allow them to wade and live in filth. This means clean yards and clean, well-bedded stalls. Everything short of this is positively repulsive and should not be tolerated any longer in a civilized community.

To stop the filthy practice known as "wetting the teats," by which is meant the drawing of a little milk into the hands with which to wet the teats before and during milking, leaving the excess of filthy milk to drop from the hands and teats into the pail.

To wash all utensils *clean* by first using lukewarm water, afterwards washing in warm water, and rinsing in an abundance of boiling water, then exposing until the next using in direct sunlight, which is a good sterilizer.

To use milk pails, cans, etc., for *no other purpose* but to hold milk.

To keep out of these utensils all sour or tainted milk, even *after* they have been used for the day. Using them for this purpose at any time infects them so badly that no amount of washing is likely to clean them. Bacteria are invisible, and millions can find lodging place in the thin film of moisture that remains after dishes are *apparently* clean.

To brush down the cobwebs and keep the barn free from accumulations of dust and trash.

To whitewash the barn at least once a year.

If these changes can be brought about, they will secure a comparatively clean product, and the improvement will amount almost to a reformation in the milk producing business. These changes involve but insignificant expense, either in money or labor, and there is no rational reason why they should not be made without delay, voluntarily, if possible, by compulsion if necessary.

When the dairy and surroundings are in the best shape possible for the present, a statement should be made as to the conditions under which the milk is produced, not claiming more than is actually carried out each day. By gradually raising his standard the industrious dairyman may, in time, work up to the grade known as certified milk.

Improving city milk supply is a matter of educating the public to demand better milk, and when the advantages of high grade milk are fully appreciated, people will be willing to pay the extra cost of production. The consuming public and the better class of dairymen are alike interested in bringing about these improvements with as little delay as possible.

NEED OF INSPECTION.

There are, and doubtless always will be, certain men producing milk who, from the slovenly methods they practice, are a disgrace to the dairy business. Such laws should be enacted, and such a system of inspection instituted, as will compel these men to be decent in their practices in handling milk or quit the business. It is time the dairymen moved in this matter and asked for inspection. If they do not, the public will soon do so, and when such matters are taken in hand by those who do not have the necessary technical information on the subject, the business may be injured and injustice done to honest dairymen who are putting out a good grade of milk.



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